299-E33-08 (A4872)

Log Data Report

Borehole Information:

Borehole: 299-E33-08 (A4872)			Site: North of 216-B-41 Trench		
Coordinates (WA State Plane)		GWL (ft)[1]: 252.7		GWL Date: 2/13/02	
North	East	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
137,447.9 m	573,475.3 m	Sept. 1953	654.3 ft	257	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel Welded	3.7	8.75	8.0	0.375	0	257

Borehole Notes:

The logging engineer measured the stickup using an engineer's tape. On the ground surface, a 2-ft-diameter, 6-in.-thick concrete pad surrounds the borehole. Casing stickup was measured between a reference point survey "X" engraved on top of the casing and the top of the concrete pad. HWIS[3] is the source of the TOC elevation and coordinates. The top of the casing is squarely cut. Casing bottom (TOC reference) is reported from information provided on the as-built drawing (Ledgerwood 1993) for this borehole. On 02/13/02, the borehole was swabbed, and no contamination was detected.

Logging Equipment Information:

Logging System:	Gamma 2B		Type: SGLS (35%)
Calibration Date:	11/01/01	Calibration Reference:	GJO-2002-287-TAR
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	Repeat
Date	02/13/02	02/14/02	02/19/02	02/25/02	02/25/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	4.0	81.0	134.5	258.5	229.0
Finish Depth (ft)	82.0	135.5	215.0	214.0	255.0
Count Time (sec)	100	100	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	N/A[4]	N/A	N/A	N/A	N/A
Pre-Verification	B0083CAB	B0084CAB	B0085CAB	B0086CAB	B0086CAB
Start File	B0083000	B0084000	B0085000	B0086000	B0086090
Finish File	B0083156	B0084109	B0085161	B0086089	B0086142
Post-Verification	B0083CAA	B0084CAA	B0085CAA	B0086CAA	B0086CAA

Log Run	1	2	3	4	Repeat
Depth Return Error (in.)	0	+1.6	-0.5	NA	-1
Comments	Fine-gain adjustment notes below.	No fine-gain adjustments made.	Fine-gain adjustment notes below.	Fine-gain adjustment notes below.	Fine-gain adjustment notes below.

Logging Operation Notes:

Zero reference is the top of casing.

Pre- and post-survey verification measurements employed the Amersham KUT verifier with SN 082.

Logging was performed with a centralizer installed on the sonde. Fine-gain adjustments were made to keep the 1460-keV (^{40}K) photopeak at a designated channel. During logging run 1, 02/13/02, fine-gain adjustments were made after files B0083067, -092, -106, and -116. During logging run 3, 02/19/02, fine-gain adjustments were made after files B0085039 and -126. On 02/25/02, during log run 4, the repeat log run, and also during the pre- and post-surveys, the sonde was enclosed in a plastic bag. Fine-gain adjustments were made after files B0086000, -044, -095, and -117. Logging was suspended at file B00860092 to swab two boreholes. Logging was resumed at file B00860093.

Analysis Notes:

Analyst:	Sobczyk	Date:	03/04/02	Reference:	MAC-VZCP 1.7.9, Rev. 2

Pre-run and post-run verification spectra were collected at the beginning and end of each day. The recorded peak counts per second (cps) for the 609-keV peak, 1461-keV peak, and 2615-keV peak were consistently lower each day in the post-run verification as compared to the pre-run verification. These changes varied from 3 to 10 percent. All of the verification spectra were within the control limits except for files B0083CAA, B0084CAB, B0086CAB, and B0086CAA. B0083CAA was recorded at the end of logging run one and fell below the criteria for the 1460 keV counts per second. B0084CAB was recorded prior to logging run two, and the FWHM[5] was too broad at both 609 and 1460 keV. B0086CAB and B0086CAA were recorded prior to and after logging on 02/25/02. The FWHM was too broad at 609 keV in the morning on 02/25/02. The recorded 2615 cps, in the afternoon, was less than 90% of that recorded in the morning of 02/25/02. Examinations of spectra indicate that the detector appears to have functioned normally during all of the logging runs, and the spectra are provisionally accepted, subject to further review and analysis. The post-run verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR.

Spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated in EXCEL (source file: G2BNov1.xls), using parameters determined from analysis of calibration data collected in November 2001. Zero reference is the top of the casing. Based on the As-Built diagram (Ledgerwood 1993) and the observations of the logging engineer, the casing configuration was assumed to be one string of 8-in. casing with a thickness of 0.375 in. to a log depth of 258.5 ft. This casing thickness is consistent with the logging engineer's measurements. A water correction was applied at 252.7 ft. Dead time corrections were not needed because dead time did not exceed 10.5 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. In addition, comparison log plots of man-made radionuclides and gross gamma are provided to compare the data collected by the Waste Management Federal Services NW Radionuclide Logging System (RLS) with SGLS data. Unless otherwise noted, all radionuclides are plotted

in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The combination plot includes a neutron-moisture log that is based on RLS data collected in June 1999. The plot of the repeat log demonstrates good repeatability of the SGLS data for both the man-made and naturally occurring radionuclides.

Results and Interpretations:

^{137}Cs, ^{60}Co, and ^{125}Sb were detected in this borehole. A zone of ^{137}Cs contamination was detected near the ground surface (log depths 4.0 and 4.5 ft) with activities ranging from 0.7 to 1.25 pCi/g. Between 30 and 43 ft, ^{137}Cs was detected at activities ranging from 0.3 to 7.3 pCi/g. ^{137}Cs was detected at activities ranging from 0.3 to 3.5 pCi/g in the interval from 227.5 to 250.5 ft. In addition, ^{137}Cs contamination was detected near the MDL (about 0.3 pCi/g) at log depths 9.0, 56.0, and 163.5 ft. ^{60}Co was detected at activities ranging from 0.1 to 0.3 pCi/g in the interval from 251.5 to 258.5 ft and below the recently reported groundwater level (252.7 ft). Between 31 and 61.5ft, ^{60}Co was detected at activities ranging from 0.1 to 0.6 pCi/g. ^{125}Sb was detected in the zone between 32 and 34 ft at activities ranging from near the MDL (1 pCi/g) to 2.5 pCi/g.

Recognizable changes in the KUT logs occurred in this borehole. Changes of about 4 pCi/g in apparent ^{40}K activities occur at about 28 and 212 ft. The concentrations of ^{137}Cs below about 30 ft correspond with the increase in ^{40}K activities and the transition from the coarse-grained sediments of the Hanford H1 to the finer grained sediments of the Hanford H2. About a 1/2-pCi/g increase in ^{232}Th occurs at 34 ft, which corresponds with a spike on the neutron-moisture log.

The behavior of the ^{238}U log suggests that radon may be present inside the borehole casing. This effect is seen in log run 1 (4.0 to 82.0 ft). The effects of radon appear to be minimal in the subsequent log runs. Radon daughters such as ^{214}Bi may also “plate” onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb. This phenomenon appears to best explain the observed ^{238}U values in log run 1. The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

Comparison log plots of data collected in 1999 with the RLS and 2002 by MACTEC-ERS are included. The RLS data are decayed to the date of the SGLS logging event in February 2002. Based on the total gamma curves, the SGLS and RLS logs are on-depth. In the interval from 4 to 82 ft (SGLS logging run one), the differences between the two curves are attributed to the presence of radon in the borehole during the first day of SGLS logging. The apparent concentrations for the man-made radionuclides show good agreement between the logging systems when concentrations are above the SGLS MDL. There do not appear to be any significant changes in contaminant profile over the last three years.

Gross gamma profiles from (Fecht et al. 1977) indicate that significant amounts of gamma-emitting contamination were present below 200 ft as early as May 1959. Fecht et al. (1977) present log runs from 5/5/59 and 2/20/76. The gamma contamination appears to start at about 230 ft (70 m) in 1959 versus about 246 ft (75 m) in the later log run. Ledgerwood (1993) reported that the depth to water was about 215 ft (relative to ground surface in November 1989). It is speculated that the ^{137}Cs detected below 227 ft was emplaced prior to May 1959 and that the ^{60}Co detected below 250 ft was present in February 1976.

References:

Fecht, K.R., G.V. Last, and K.R. Price, 1977. *Evaluation of Scintillation Probe Profiles From 200 Area Crib Monitoring Wells*, ARH-ST-156, UC-70, Atlantic Richfield Hanford Company, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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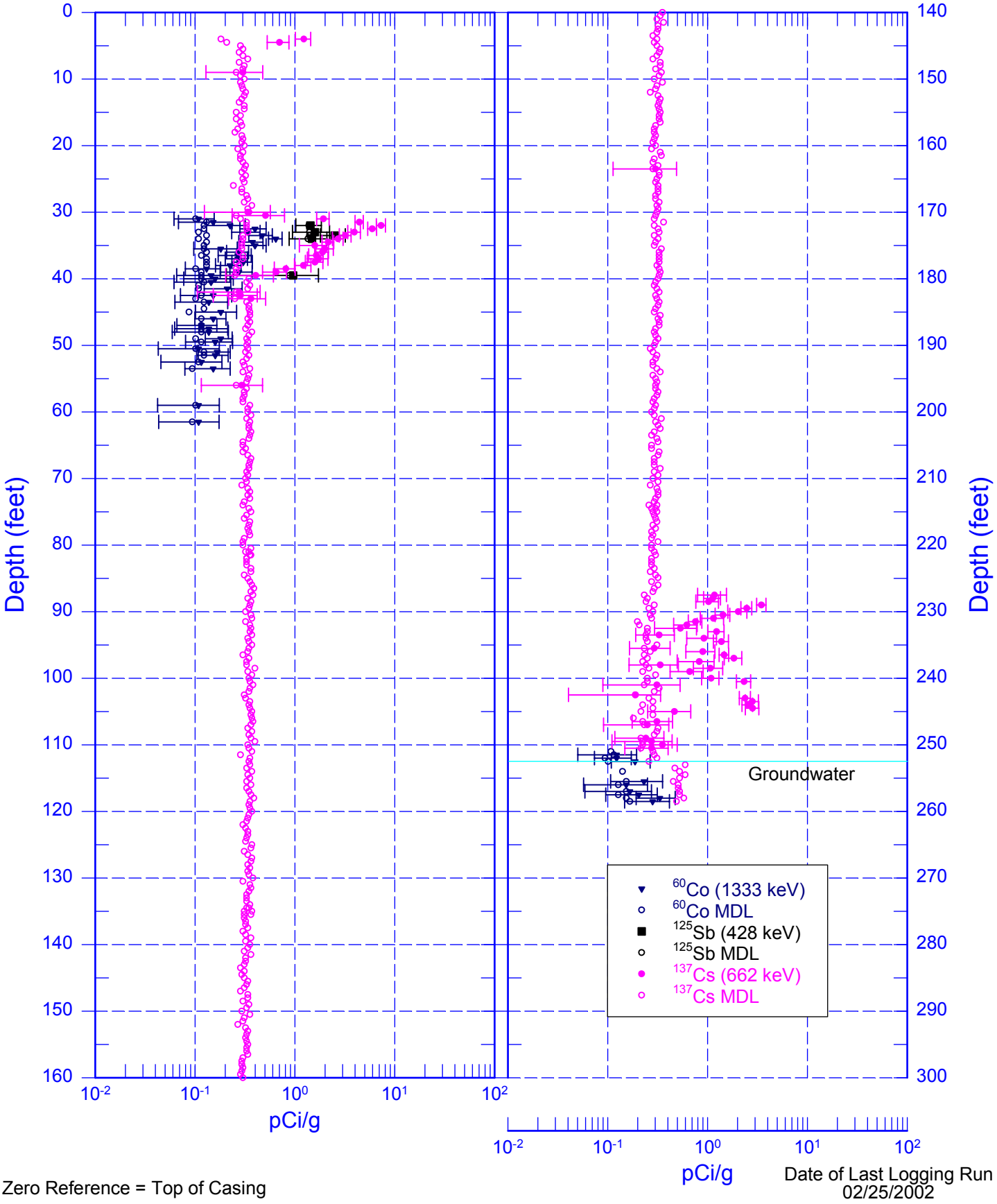
[1] GWL – Groundwater level
[2] TOC – Top of casing
[3] HWIS – Hanford Well Information System
[4] N/A – not applicable
[5] FWHM – Full Width Half Maximum

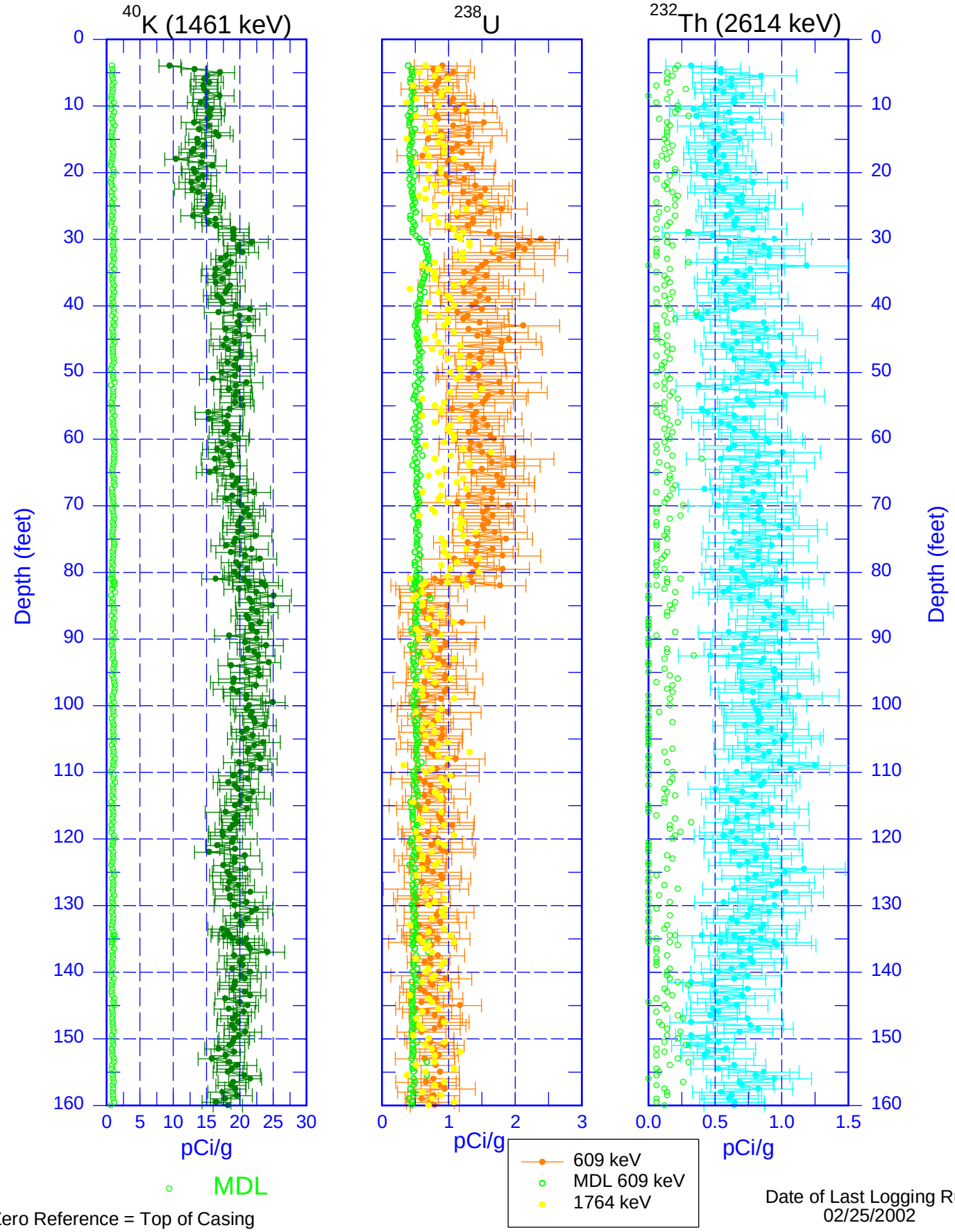
299-E33-08 (A4872)
Man-Made Radionuclides



Zero Reference = Top of Casing

Date of Last Logging Run
02/25/2002

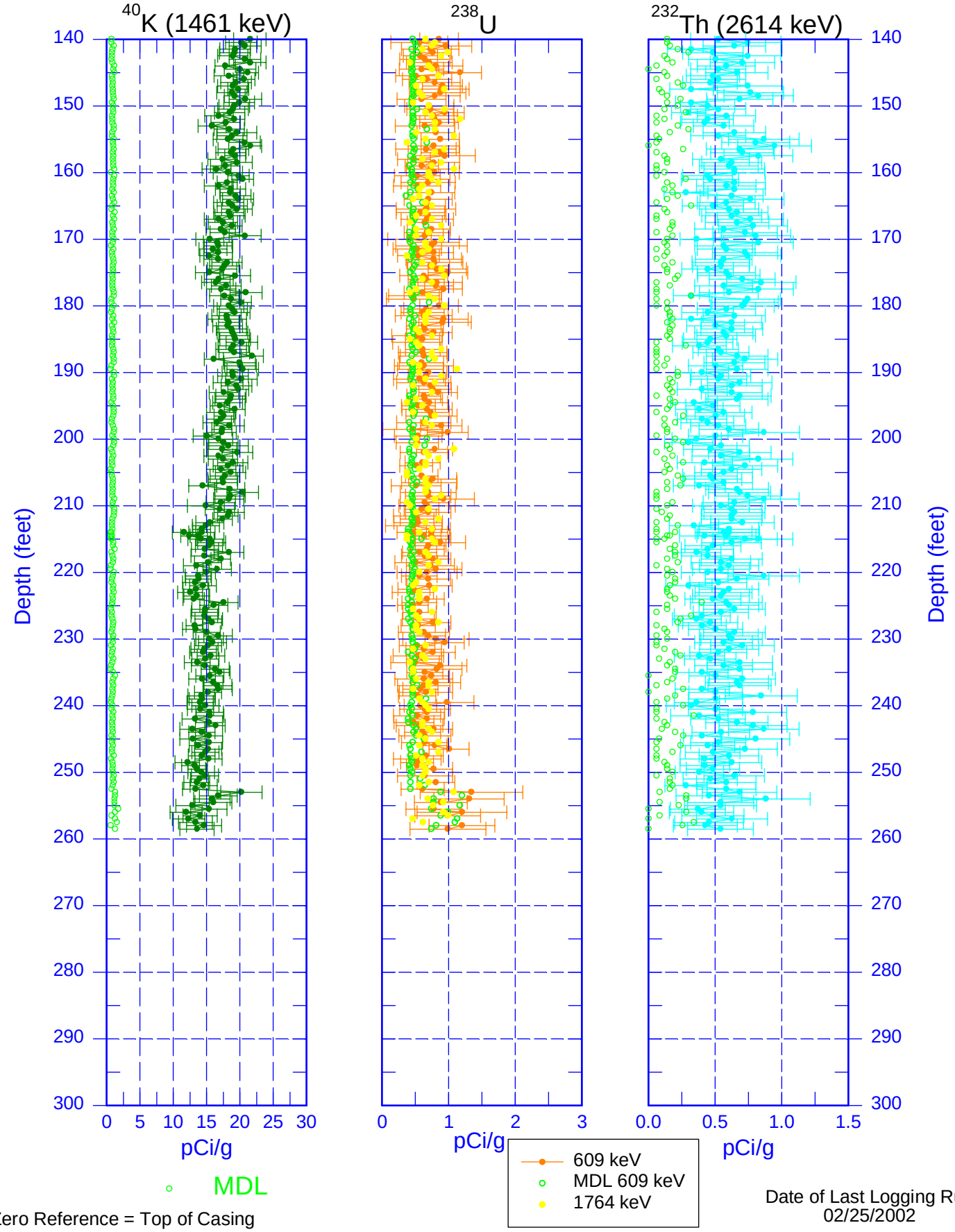
299-E33-08 (A4872)
Natural Gamma Logs



Zero Reference = Top of Casing

Date of Last Logging Run
02/25/2002

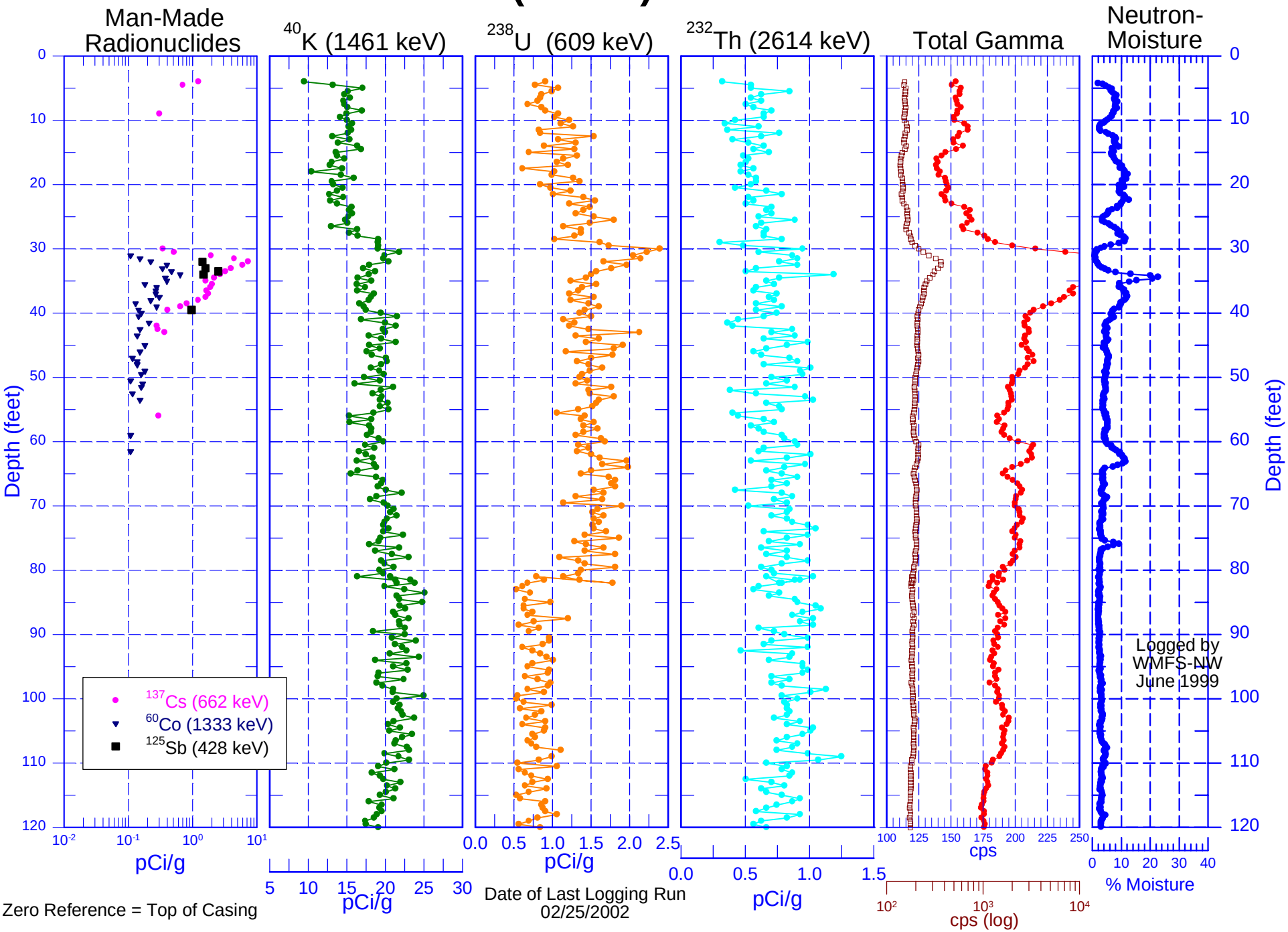
299-E33-08 (A4872)
Natural Gamma Logs



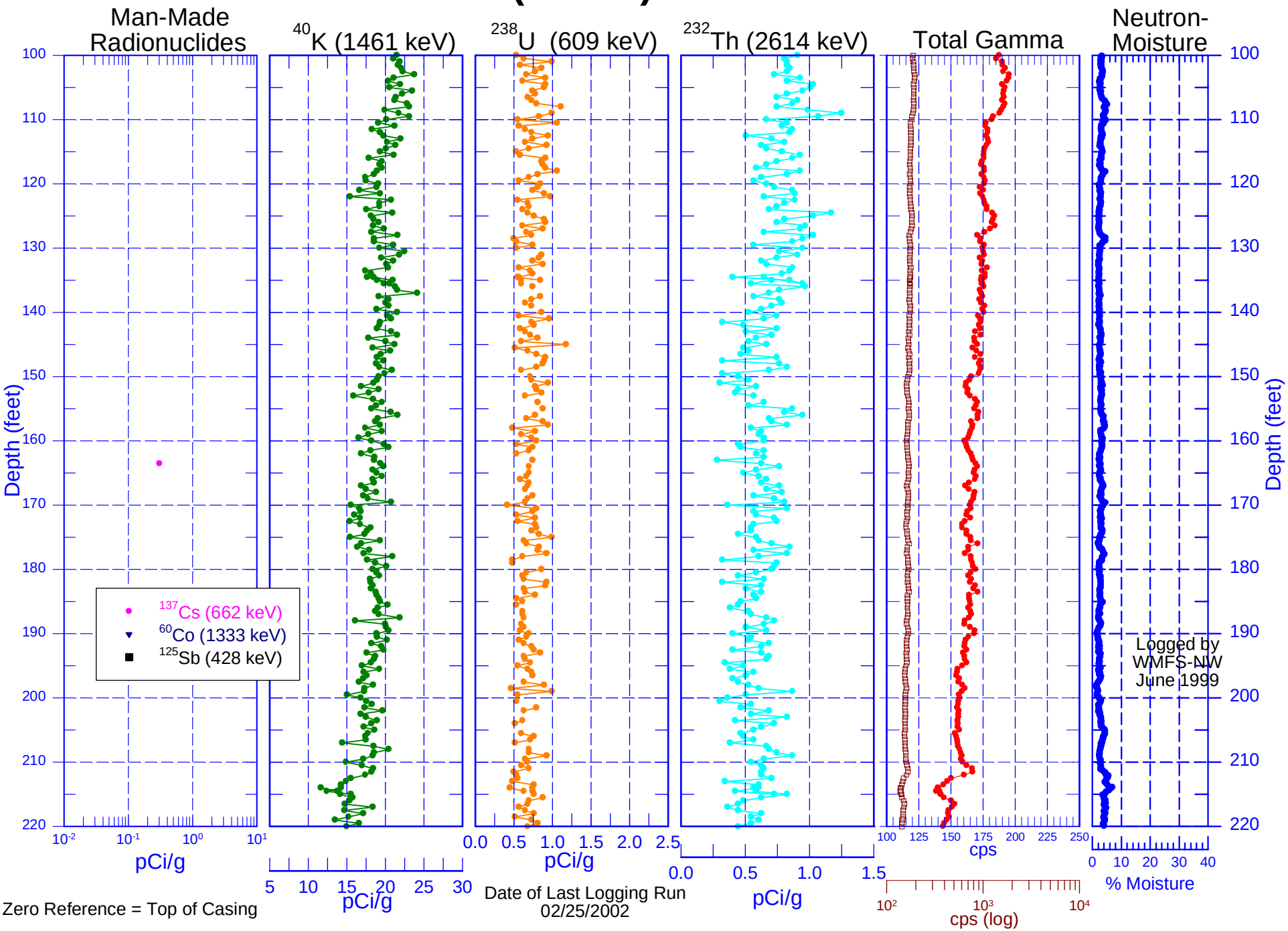
Zero Reference = Top of Casing

Date of Last Logging Run
02/25/2002

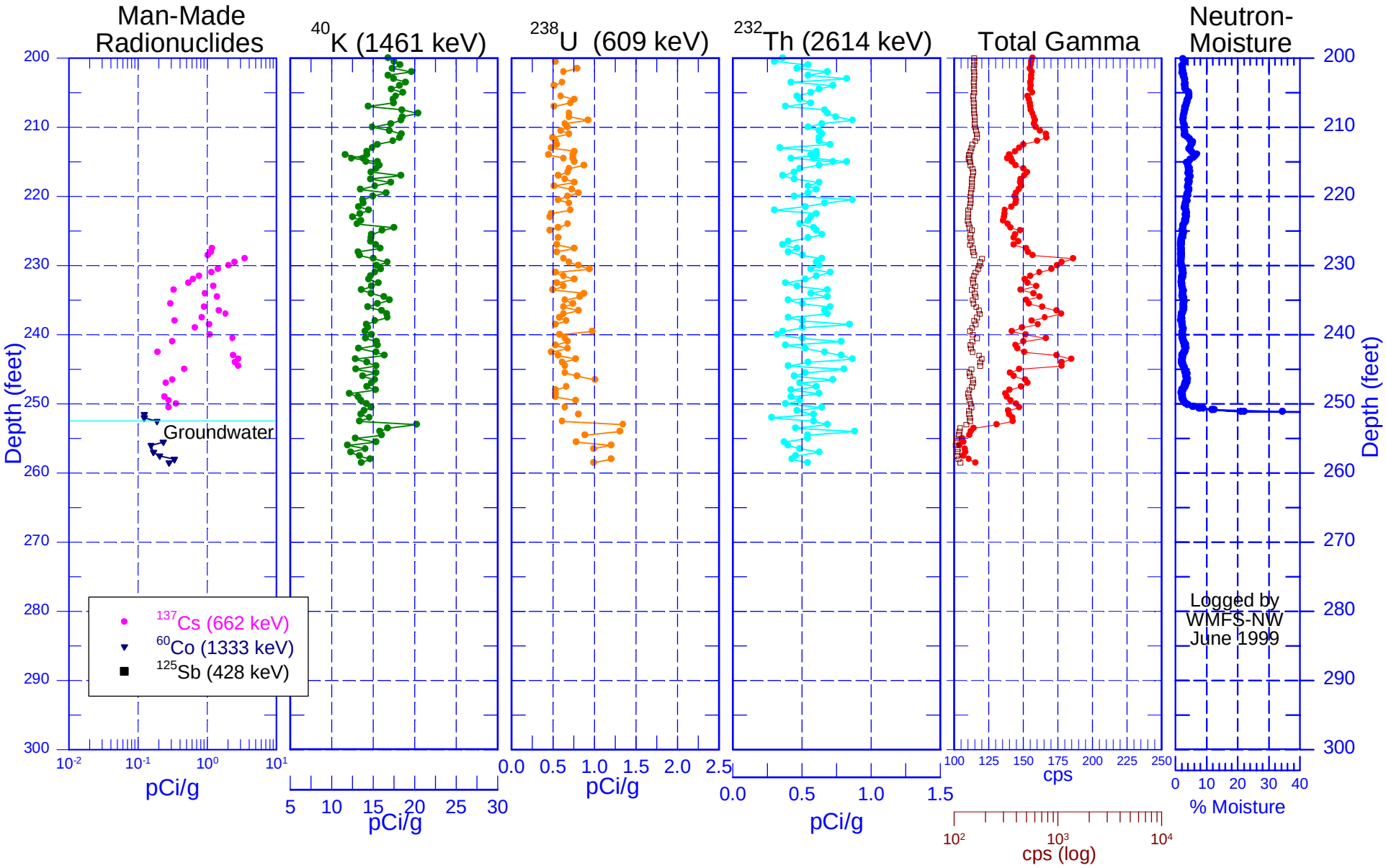
299-E33-08 (A4872) Combination Plot



299-E33-08 (A4872) Combination Plot



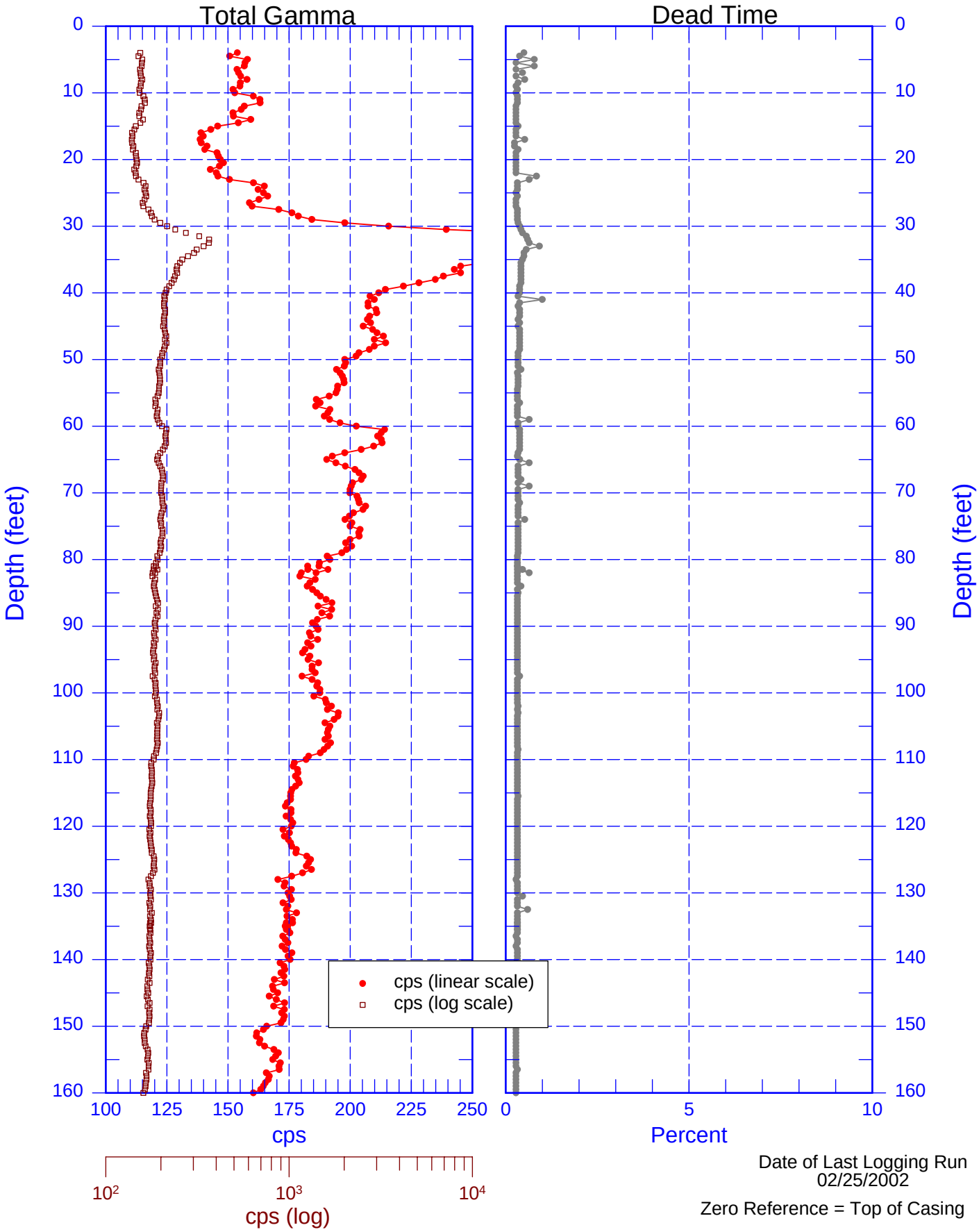
299-E33-08 (A4872) Combination Plot



Zero Reference = Top of Casing

Date of Last Logging Run
02/25/2002

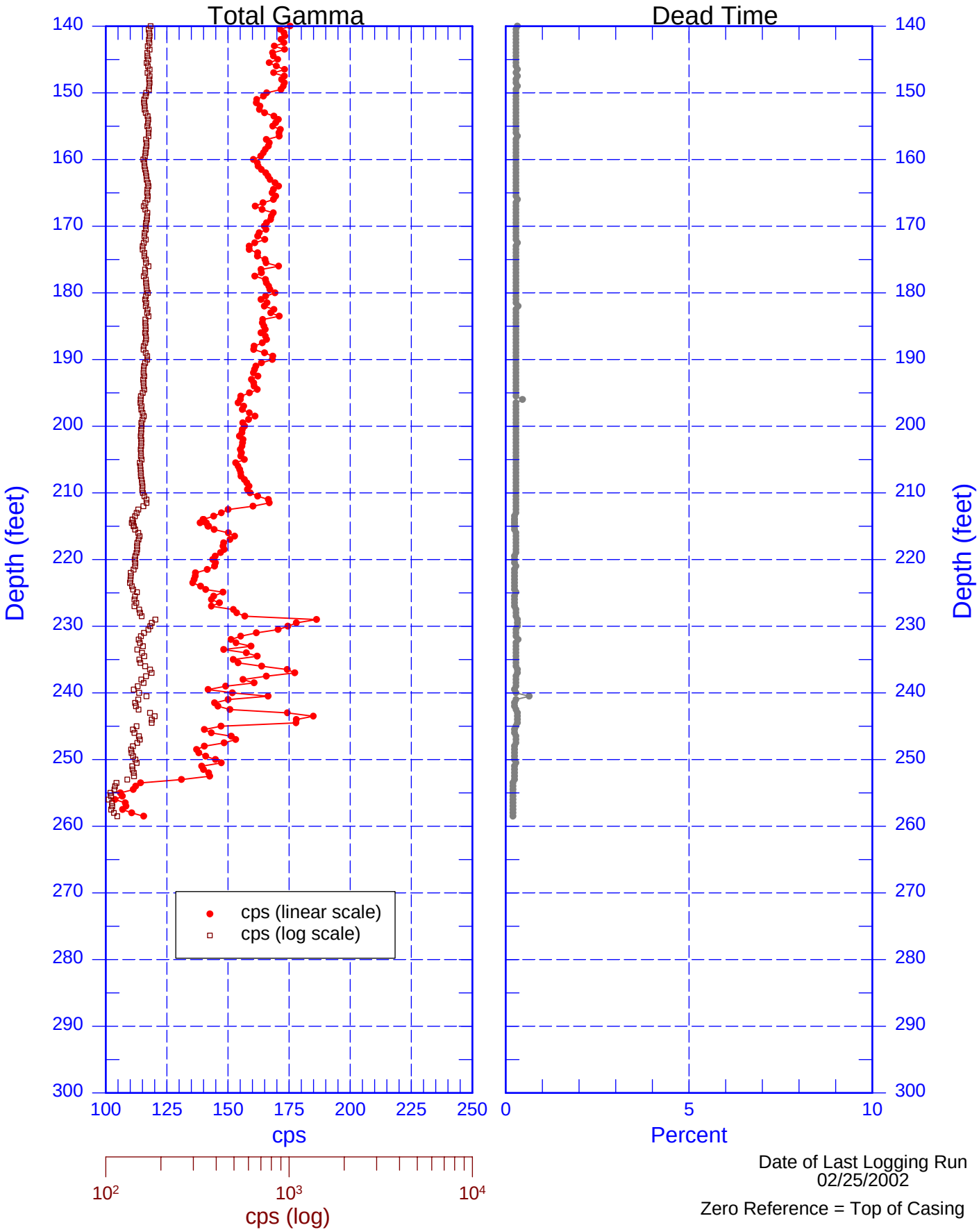
299-E33-08 (A4872)
Total Gamma & Dead Time



Date of Last Logging Run
02/25/2002

Zero Reference = Top of Casing

299-E33-08 (A4872)
Total Gamma & Dead Time

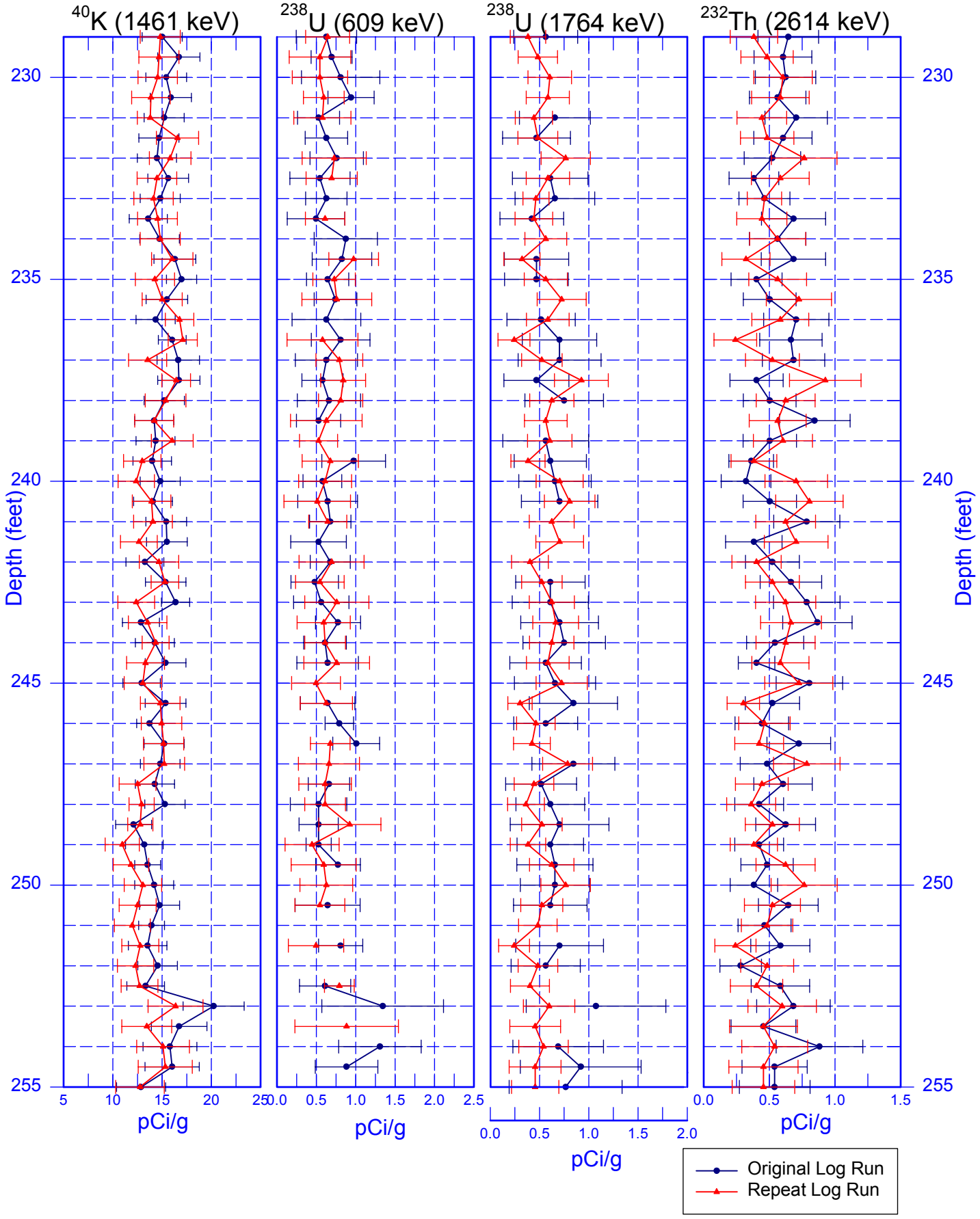


Date of Last Logging Run
02/25/2002

Zero Reference = Top of Casing

299-E33-08 (A4872)

Rerun of Natural Gamma Logs



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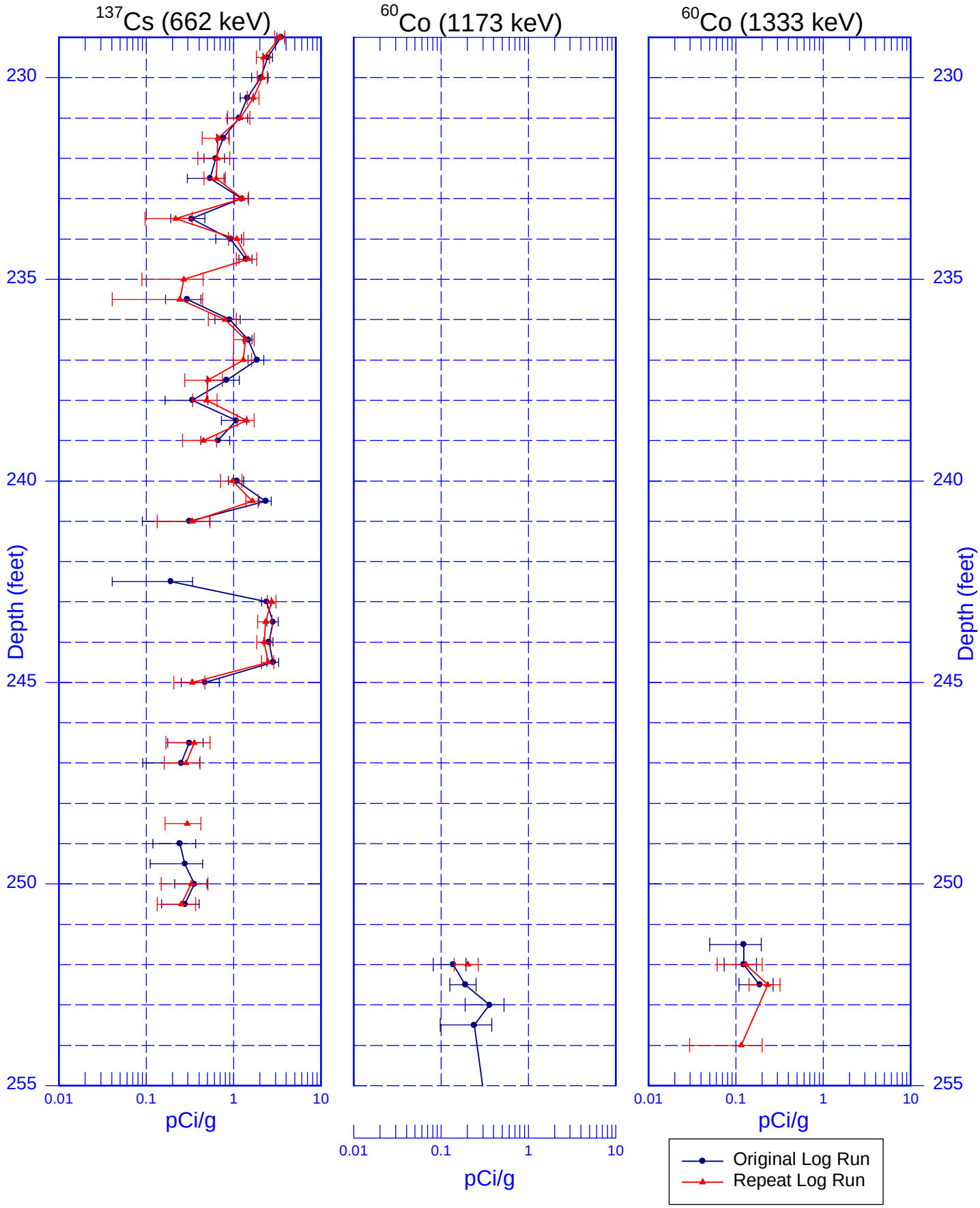
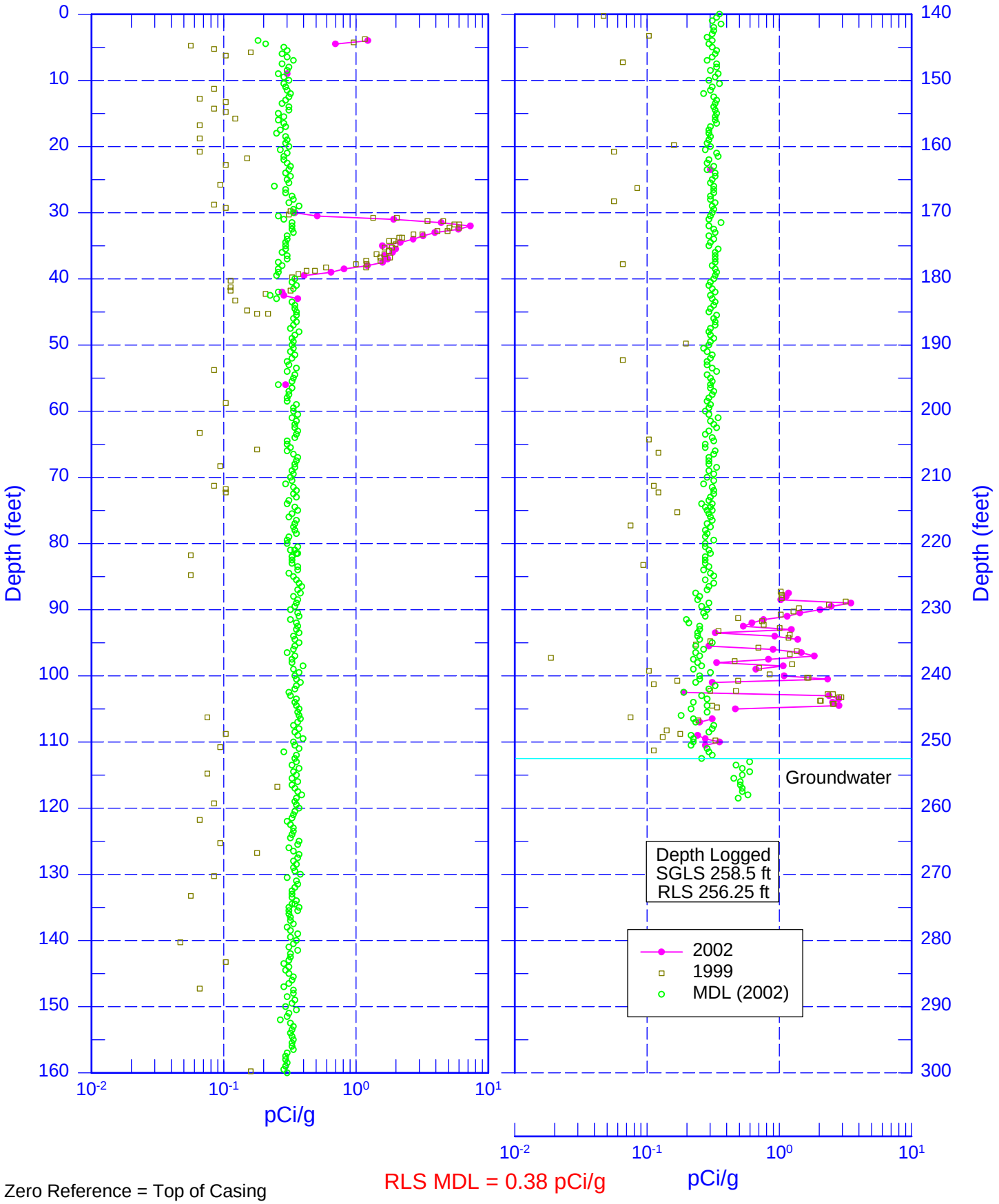
Rerun of Man-Made Radionuclides (229-255 ft)



299-E33-08 (A4872)

RLS Data Compared to SGLS Data

^{137}Cs Decayed to 02/25/2002

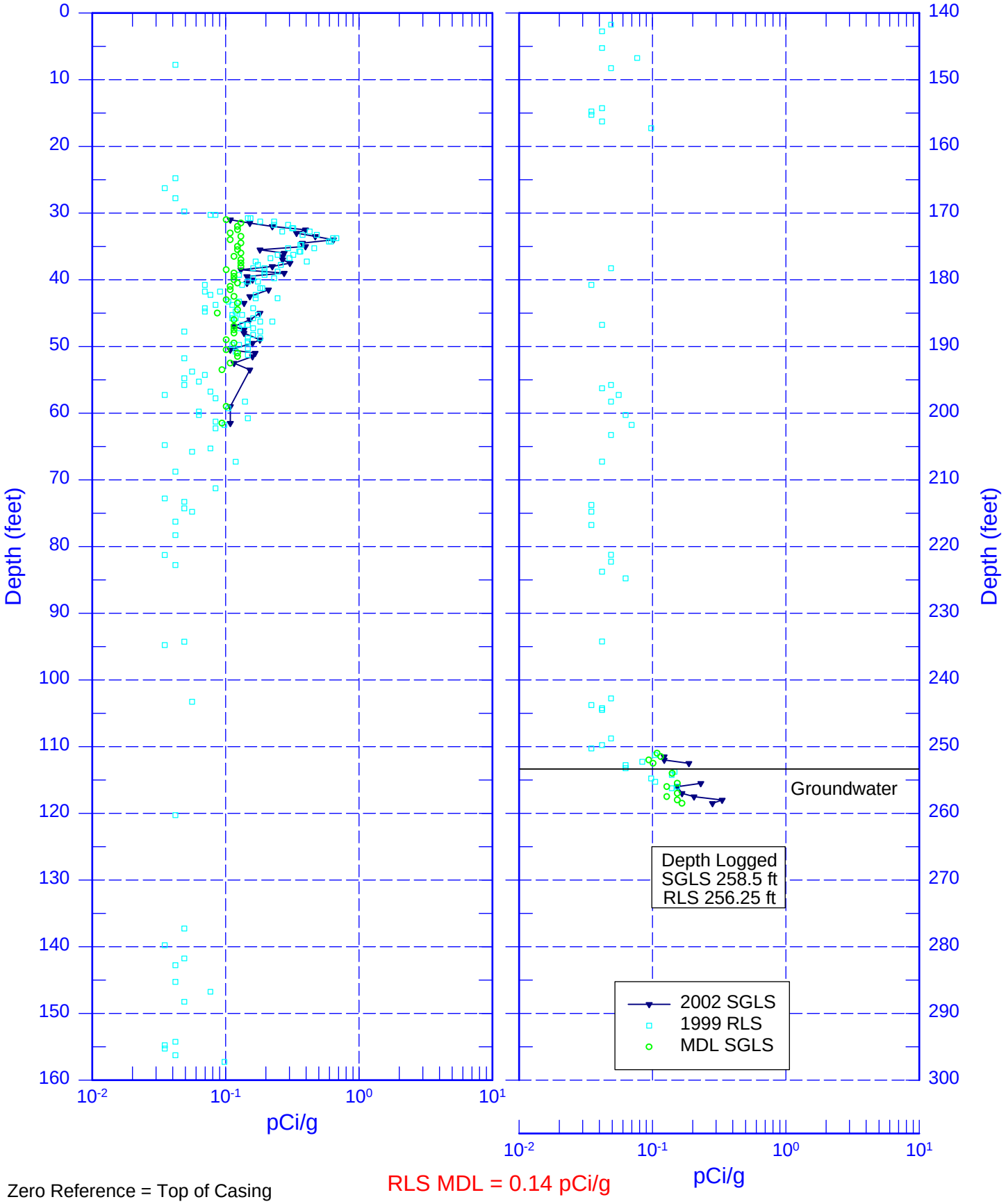


Zero Reference = Top of Casing

299-E33-08 (A4872)

RLS Data Compared to SGLS Data

^{60}Co Decayed to 02/25/2002

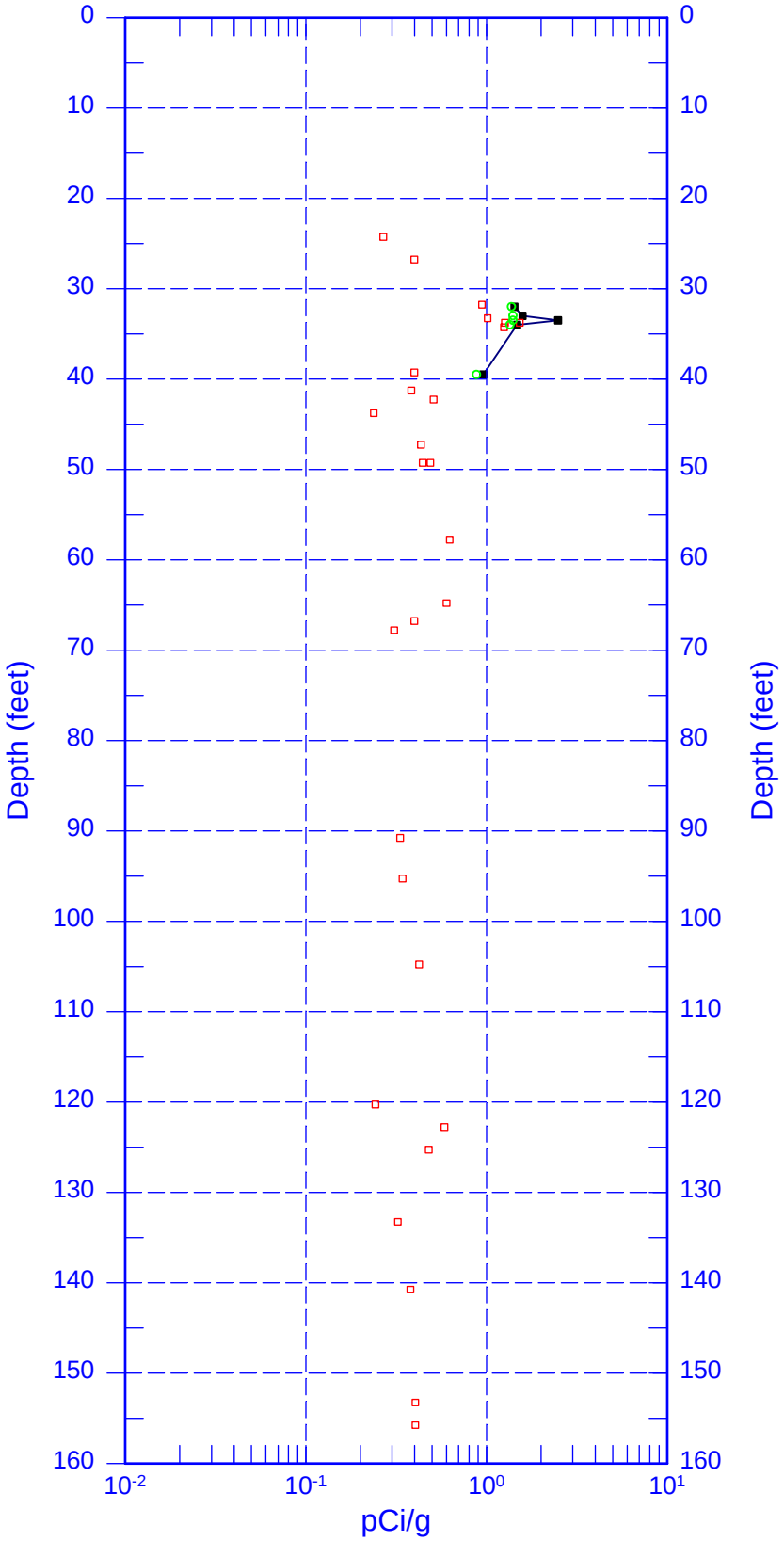


Zero Reference = Top of Casing

299-E33-08 (A4872)

RLS Data Compared to SGLS Data

^{125}Sb Decayed to 02/25/2002



RLS MDL = 1.3 pCi/g

Zero Reference = Top of Casing